Special Provisions Section 10-1.035 "Marine Pile Driving Energy Attenuator," is added as follows:

MARINE PILE DRIVING ENERGY ATTENUATOR SPECIFICATION

This work shall consist of designing, furnishing, installing, operating, monitoring, maintaining and removing an air bubble curtain system to attenuate underwater energy generated by driving steel shell piles.

The approved attenuation system shall be operating prior to beginning pile driving at any given pile location. If the attenuator fails, as determined by the Engineer, pile driving shall immediately stop. Pile driving at any given location shall not resume until the attenuator system at the location is again operating in conformance with the requirements of this specification, as determined by the Engineer.

Failure of the attenuation system shall include, but is not limited to, the following as determined by the Engineer:

1. The pressure or flow rate in any meter falls below 90% of its operating value during the pile driving operation;
2. During inspection of the perforated pipe the Engineer determines that erosion of the holes or debris has clogged the holes that will degrade the performance of the system.
3. The bottom ring is not in contact with the bay bottom.

The Contractor shall make provisions for the Engineer to inspect the bubble curtain system for proper operation before each deployment and as necessary during deployment. Proper operation during deployment will be determined by observation of the gauges in the monitoring station and by other methods developed by the Engineer.

The Contractor shall provide adequate means to prevent light from the pile driving operation from shining directly into the water. At least 15 minutes prior to and during pile driving operations, the Contractor shall not shine light directly into the water.

GENERAL

An air bubble curtain system is generally composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipes, and a frame. The frame facilitates transport and placement of the system, keeps the aeration pipes stable, and provides ballast to counteract the buoyancy of the aeration pipes in operation.

Air bubble curtain system shall conform to the following:

1. Air bubble system shall consist of multiple and concentric layers of perforated aeration pipes stacked vertically in accordance with the following:

Water Depth (m)	No. of Layers
0 to less than 5	2
5 to less than 10	4
10 to less than 15	7
15 to less than 20	10
20 to less than 25	13

2. Pipes in any layer shall be arranged in a geometric pattern, which shall allow for the pile driving operation to be completely enclosed by bubbles for the full depth of the water column and for the radial dimension of no more than 0.5 meters as measured from the outside surface of the pile.
3. The lowest layer of perforated aeration pipes shall be designed to ensure contact with the mudline without sinking into the bay mud.
4. The system shall provide a bubble flux of 2.0 cubic meters per minute per linear meter of pipe in each layer. Air holes shall be 1.6 mm in diameter and shall be spaced approximately 20 mm apart. Air holes shall be placed in four adjacent rows along the pipe to provide uniform bubble flux.
5. Air compressors used over water shall be oil free.

6. Meters shall be provided in accordance with the following:

   6.1. Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.
   6.2. Flow meters shall be installed in the main line at each compressor and at each branch in the aeration pipelines at each inlet. In applications where the feedline from the compressor is continuous from the compressor to the aeration pipe inlet the flow meter at the compressor can be eliminated.
   6.3. Flow meters shall be installed according to the manufacturer's recommendation based on either laminar flow or non-laminar flow, whichever applies.

Gauges shall be installed above the water line and shall be easily accessible to the Engineer. The Contractor shall keep a continuous electronic log of all meters and gauges when the system is operating. Readings shall be logged every 30 minutes and at other times, as determined by the Engineer, when variation in the readings exceeds 10%. The Contractor shall maintain a graphical plot showing the variation of the meter readings with time. Air pressure and air flow meters and gauges shall be calibrated by a private laboratory approved by the Engineer prior to use in the attenuator system. Meters shall be accurate to within 2 percent.

The Contractor shall monitor the condition of the attenuator system and prepare inspection reports daily during pile installation operations and no less than every other day during period of no activity.

The Contractor's design, installation, maintenance, monitoring, operation and removal of the attenuator system shall take into account the site conditions and the requirements of pile installation. Factors to be taken into account include anchoring, moving, and dismantling the system; configuration of bay bottom; water velocity; water-surface conditions; air and water temperatures; and positioning of pile and pile-driving equipment relative to the bubble curtain system.

Water velocity at the site is expected to vary from zero to 2 knots and vary in direction due to changes in tidal flow. The design of the system shall ensure that the system extends from the bay bottom to the water surface during maximum water-current conditions and accommodates tidal changes.

The Contractor shall completely remove the attenuator system at the completion of the project and the system will remain the property of the Contractor.

WORKING DRAWINGS

The Contractor shall submit working drawings with supplement for the attenuator system to the Engineer for approval in conformance with the provisions in "Working Drawings," except as otherwise noted.

Working drawings with supplement shall be signed by a Mechanical Engineer who is registered in the State of California. Working drawings shall include the following:

1. Complete details of the system including mechanical and structural details.
2. Details of anchorage components, air compressors, supply lines, distribution manifolds, aeration pipes and frame.
3. Details of meters, gauges, and recording devices.
4. Details of the manufacturer's recommendations for installation of the flow meter in conditions of laminar flow and non-laminar flow.

The supplement to the working drawings shall include the following:

1. Independently checked design calculations.
2. Materials list including the name of the manufacturer and the source, model number, description, and standard of manufacture.
3. Manufacturer's descriptive data and catalog cuts for all products produced for the system including air compressors.
4. Calculations showing pressure loss in the piping system and estimated flows from the most removed orifice of the aeration piping.

The Contractor shall allow the Engineer 20 working days to review the working drawings. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the working drawings within 15 working days of receipt of the Engineer's comments. The Contractor shall allow the Engineer 10 working days to review the revised working drawings

The Contractor shall submit inspection report in conformance with "Working Drawings," within 48 hours following inspection.